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WISCONSIN UNIV-MADISON DEPT OF COMPUTER SCIENCES
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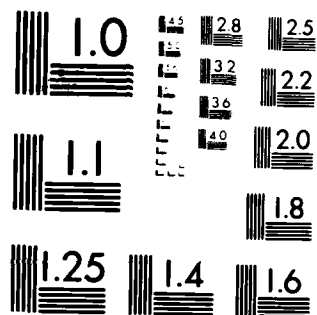
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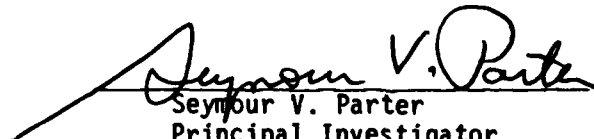
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Seymour V. Parter
Principal Investigator

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Goals of the Grant

The proposal to AFOSR emphasized research on solving Elliptic-Parabolic Problems. Topics of special interest were:

- (1) The extension of the basic theory of classical iterative methods.
- (2) The study of multigrid methods.

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2. Progress to Date

Three reports were completed during this period. They are

- (1) S.V. Parter and M. Steuerwalt; Iterative Methods for Discrete Elliptic Equations. To Appear: Proc. Sixth International Conference on Computing Methods in Engineering and Applied Science - INRIA (France) 1983. Also, University of Wisconsin Computer Sciences Dept. Report #525.
- (2) S.V. Parter; Iterative Methods for Elliptic Problems and the Discovery of "q". Submitted to: SIAM Review. Also, University of Wisconsin Computer Sciences Dept. Report #548.
- (3) D. Kamowitz and S.V. Parter, A Study of Some Multigrid Ideas, To Appear: Applied Mathematics and Computation. Also, University of Wisconsin Computer Sciences Dept. Report #545.

The first two reports essentially complete our efforts on the study of the classical iterative methods. There are still plans to look into (i) an experimental study of "point" SOR methods for finite-element equations, and (ii) Conjugate Gradient methods. And while those plans are presently well organized and prepared, these projects have been given lower priority.

The third report is an extensive study of Jacobi type multigrid methods applied to the (seemingly) non-self adjoint problem

$$-(au')' + bu' + cu = f, \quad 0 < x < 1$$

$$u(0) = u(1) = 0$$

This work is both theoretical and computational. Indeed, in addition to the report, one of the most valuable results of this project is a flexible experimental tool - namely a computer code - which can be used, and is continuing to be used, to obtain numerical results for many interesting questions. With this code we can generate insights and conjectures concerning more general and less well-understood situations.

In an ongoing study, which is not yet at the point where a report can be written, we are extending the MGR[v] schemes of M. Ries, U. Trottenberg, and G. Winter and B. Braess. The initial theoretical parts of this study were completed during the period discussed in this report. In this initial work we formulated the generalization of the MGR[v] multigrid method to diffusion equations with variable diffusivity and proved a basic estimate. During the year we also began the preparation of a computer code which will be a useful experimental tool both to complement our theoretical estimates and provide insights and suggestions for methods of improving the scheme. The theoretical work is also continuing.

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